MATERIAL SAFETY DATA SHEET PACKET

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2320
Gaithersburg, Maryland 20899-2320

MSDS Coordinator: Mario Cellarosi
Telephone: 301-975-6776
FAX: 301-926-4751
E-mail: SRMMSDS@nist.gov

SRM Number: 674b
MSDS Number: 674b
SRM Name: X-Ray Powder Diffraction Intensity Set

Date of Issue: 21 September 2005

Emergency Telephone Chem Trec:
1-800-424-9300 (North America)
+1-703-527-3887 (International)

Description: Standard Reference Material (SRM) 674b is a set of four oxide powders which are intended primarily for use as internal standards for Quantitative X-ray diffraction analysis. A unit of SRM 674b consists of approximately 10 g of each powder bottled under argon. The powders are:

Zinc Oxide (ZnO)

Titanium Dioxide (TiO_2)

Chromium (III) Oxide (Cr_2O_3)

Ceric Oxide (CeO_2).

MATERIAL SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

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Substances: **Zinc Oxide (ZnO)**; Titanium Dioxide (TiO_2); Chromium (III) Oxide (Cr_2O_3); and Ceric Oxide (CeO_2)

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component:	**Zinc Oxide**
Other Designations:	**Zinc Oxide** (zinc white; zinc monoxide; ozide; white zinc; zincoid)
CAS Number:	1314-13-2
EC Number (EINECS):	215-222-5
SRM Nominal Concentration:	95 (mass %)
EC Classification:	Xi
EC Risk:	R37
EC Safety:	S2, S24, S46
EC Risk/Safety Phrases:	See Section 15, "Regulatory Information"

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0–4): Health = 2 Fire = 0 Reactivity = 0

Major Health Hazards: Respiratory tract irritation.

Potential Health Effects

Inhalation: Inhalation of dust or fumes may cause irritation of the respiratory tract and mucous membranes. Symptoms may include breathing difficulties.

Skin Contact: Low potential for skin irritation.

Eye Contact: Dusts or fumes of zinc oxide may cause mechanical irritation, redness, and pain.

Ingestion: Ingestion of zinc oxide may cause intense gastroenteritis. Symptoms include nausea, diarrhea, or constipation.

Listed as a Carcinogen/ Potential Carcinogen:

Yes	No	
____	X	In the National Toxicology Program (NTP) Report on Carcinogens.
____	X	In the International Agency for Research on Cancer (IARC) Monographs.
____	X	By the Occupational Safety and Health Administration (OSHA).

4. First Aid Measures

Inhalation: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing by qualified personnel. Get immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention if necessary.

Eye Contact: Flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Get immediate medical attention.

Ingestion: If large amounts of zinc oxide are ingested, get medical attention.

5. Fire Fighting Measures

Fire and Explosion Hazards: Zinc oxide is a negligible fire hazard.

Extinguishing Media: Use regular dry chemical, carbon dioxide, water, or regular foam. For large fires, use regular foam or flood with fine water spray.

Fire Fighting: Move container from fire area if possible without exposure to risk. Avoid inhalation of material or combustion by-products. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point: Not applicable.

Method Used: Not applicable.

Autoignition Temperature: Not applicable.

Flammability Limits in Air
Upper (Volume %): Not applicable.
Lower (Volume %): Not applicable.

6. Accidental Release Measures

Occupational Release: For large spills, collect the material in an appropriate container for disposal. Avoid generating dust. If necessary, use a high-efficiency particulate filter vacuum to clean up residue.

Disposal: See Section 13, "Disposal Considerations".

7. Handling and Storage

Storage: Store and handle in accordance with all current regulations and standards. Keep separated from incompatible substances. Store in a cool, dry, well ventilated area. Store in a tightly closed container.

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: OSHA: 5 mg/m^3 TWA (respirable dust fraction)
OSHA: 15 mg/m^3 TWA (total dust)
OSHA: 5 mg/m^3 TWA (fume)
ACGIH (TLV): 2 mg/m^3 TWA (respirable fraction)
ACHIG (TLV): 10 mg/m^3 STEL (respirable fraction)
NIOSH: 5 mg/m^3 recommended TWA (10 h) (fume, dust)
NIOSH: 15 mg/m^3 recommended ceiling (dust)
OES UK: 5 mg/m^3 TWA (fume)
OES UK: 10 mg/m^3 STEL (fume)

Ventilation: Use a local exhaust ventilation system. Ensure compliance with applicable exposure limits.

Respirator: For conditions of frequent use or heavy exposure where exposure is apparent and engineering controls are not feasible, respirator protection may be needed. Refer to the "NIOSH Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84" for selection and use of respirators certified by NIOSH.

Eye Protection: Wear safety goggles. An eye wash station should be readily available near areas of use.

Personal Protections: Wear appropriate chemical resistant clothing to prevent skin exposure.

9. PHYSICAL AND CHEMICAL PROPERTIES

Component: **Zinc Oxide**

Appearance and Odor: White or gray. Powder. Odorless.

Molecular Weight: 81.37 g/mol

Molecular Formula: ZnO

Density: 5.6 g/cm^3

Solvent Solubility: Soluble in dilute acetic acid, mineral acids, ammonia, ammonium chloride solutions, ammonium salt solutions, fixed alkali hydroxide solutions, strong alkali. Insoluble in alcohol, ether, dilute sulfuric acid.

Water Solubility: 1.6 ppm @ 29 °C

Boiling Point: Not applicable.

Melting Point: 1975 °C

10. STABILITY AND REACTIVITY

Stability: _X_ Stable ____ Unstable

Stable at normal temperatures and pressure.

Conditions to Avoid: Avoid generating dust.

Incompatible Materials: Halo carbons. Combustible materials. Metals. Acids. Oxidizing materials.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Thermal decomposition may release zinc and oxides of zinc.

Hazardous Polymerization: ____ Will Occur _X_ Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry: _X_ Inhalation ____ Skin _X_ Ingestion

Toxicity Data:	Human, Oral LD_{LO}: 500 mg/kg Human, Inhalation TC_{LO}: 600 mg/m^3 Rat, Inhalation LC_{50}: > 200 mg/L
Medical Conditions Aggravated by Exposure:	Respiratory disorders.
Health Effects (Acute and Chronic):	See Section 3, "Hazards Identification".

12. ECOLOGICAL INFORMATION

Fish Toxicity:	Fathead minnow (Pimephales promelas) LC_{50} (mortality): 2 246 mg/L (96 h)
Invertebrate Toxicity:	Water flea (Daphnia magna) LC_{50} (mortality): 98 µg/L (48 h)
Other Toxicity:	Toad (Bufo bufo japonicus) LC_{50} (mortality): 3 200 µg/L (3 weeks)

13. DISPOSAL CONSIDERATIONS

Waste Disposal:	Dispose in accordance with federal, state, and local regulations.

14. TRANSPORTATION INFORMATION

SRM 674b U.S. DOT:	Not regulated by DOT.

15. REGULATORY INFORMATION

Zinc Oxide

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Not regulated.

SARA Title III Section 302 (40 CFR 355.30): Not regulated.

SARA Title III Section 304 (40 CFR 355.40): Not regulated.

SARA Title III, Section 313 (40 CFR 372.65): Zinc Compounds.

OSHA Process Safety (29 CFR 1910.119): Not regulated.

California Proposition 65: Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE:	Yes.
CHRONIC:	No.
FIRE:	No.
REACTIVE:	No.
SUDDEN RELEASE:	No.

CANADIAN Regulations: WHMIS Classification: Not determined.

National Inventory Status: U.S. Inventory (TSCA): Zinc oxide listed on inventory.
TSCA 12b Export Notification: Zinc oxide not listed.

EC Classification:	Xi	Irritant
EC Risk and Safety Phrases:	R37	Irritating to respiratory system.
	S2	Keep out of reach of children.
	S24	Avoid contact with skin.
	S46	If swallowed, seek medical advice immediately and show container or label.

16. OTHER INFORMATION

Sources: MDL Information Systems, Inc., MSDS *Zinc Oxide*, 16 September 2004.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.

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Description: Standard Reference Material (SRM) 674b is a set of four oxide powders which are intended primarily for use as internal standards for Quantitative X-ray diffraction analysis. The powders are zinc oxide (ZnO), titanium dioxide (TiO_2), chromium (III) oxide Cr_2O_3, and ceric oxide (CeO_2). A unit of SRM 674b consists of approximately 10 g of each powder bottled under argon.

Substances: Zinc Oxide (ZnO); **Titanium Dioxide (TiO_2)**; Chromium (III) Oxide (Cr_2O_3); and Ceric Oxide (CeO_2)

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component: **Titanium Dioxide**

Other Designations: **Titanium Dioxide** (titanium [IV] oxide; titanium peroxide; titanic oxide)

CAS Number: 13463-67-7

EC Number (EINECS): 236-675-5

SRM Nominal Concentration: 90 (mass %)

EC Classification: Not determined.

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0–4): Health = 1 Fire = 0 Reactivity = 0

Major Health Hazards: No significant effects reported.

Potential Health Effects

Inhalation: Inhalation of titanium dioxide may cause irritation. Symptoms may include coughing.

Skin Contact: Acute skin exposure of titanium dioxide is reported to be non-irritating and devoid of toxicity.

Eye Contact: Acute eye exposure of titanium dioxide is reported to be non-irritating.

Ingestion: Ingestion of small quantities has been reported to be physiologically inert. Ingestion of large quantities of titanium oxide may cause intestinal obstruction.

Listed as a Carcinogen/ Potential Carcinogen:

Yes	No	
____	X	In the National Toxicology Program (NTP) Report on Carcinogens.
____	X	In the International Agency for Research on Cancer (IARC) Monographs.
____	X	By the Occupational Safety and Health Administration (OSHA).

4. FIRST AID MEASURES

Inhalation: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing by qualified personnel. Get immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention if necessary.

Eye Contact: Flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Get immediate medical attention.

Ingestion: If large amounts of zinc oxide are ingested, get medical attention.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Titanium dioxide is a negligible fire hazard.

Extinguishing Media: Use extinguishing agents that are appropriate for the surrounding fire.

Fire Fighting: Move container from fire area if possible without exposure to risk. Avoid inhalation of material or combustion by-products. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point: Not applicable.

Method Used: Not applicable.

Autoignition Temperature: Not applicable.

Flammability Limits in Air
Upper (Volume %): Not applicable.
Lower (Volume %): Not applicable.

6. ACCIDENTAL RELEASE MEASURES

Occupational Release: For large spills, collect the material in an appropriate container for disposal. Avoid generating dust. If necessary, use a high-efficiency particulate filter vacuum to clean up residue.

Disposal: See Section 13, "Disposal Considerations".

7. HANDLING AND STORAGE

Storage: Store and handle in accordance with all current regulations and standards. Keep separated from incompatible substances.

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: OSHA: 15 mg/m^3 TWA (total dust)
ACGIH (TLV): 10 mg/m^3 TWA
OES UK: 10 mg/m^3 TWA (total inhalable dust)
OES UK: 4 mg/m^3 TWA (respirable dust)

Ventilation: Use a local exhaust ventilation system. Ensure compliance with applicable exposure limits.

Respirator: For conditions of frequent use or heavy exposure where exposure is apparent and engineering controls are not feasible, respirator protection may be needed. Refer to the "NIOSH Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84" for selection and use of respirators certified by NIOSH.

Eye Protection: Wear safety goggles. An eye wash station should be readily available near areas of use.

Personal Protections: Wear appropriate chemical resistant clothing to prevent skin exposure.

9. PHYSICAL AND CHEMICAL PROPERTIES

Component:	**Titanium Dioxide**
Appearance and Odor:	Powder. Odorless.
Molecular Weight:	79.88 g/mol
Molecular Formula:	TiO_2
Density:	3.84 g/cm^3 – 4.26 g/cm^3
Solvent Solubility:	Soluble in hot concentrated sulfuric acid, hydrofluoric acid, and alkali. Insoluble in hydrochloric acid, nitric acid, and dilute sulfuric acid.
Water Solubility:	Insoluble.
Boiling Point:	2500 °C to 3000 °C
Melting Point:	1825 °C to 1850 °C

10. STABILITY AND REACTIVITY

Stability:	_X_ Stable ____ Unstable
	Stable at normal temperatures and pressure.
Conditions to Avoid:	Avoid generating dust.
Incompatible Materials:	Metals.
Fire/Explosion Information:	See Section 5, "Fire Fighting Measures".
Hazardous Decomposition:	Thermal decomposition may release oxides of titanium.
Hazardous Polymerization:	____ Will Occur _X_ Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry:	_X_ Inhalation ____ Skin ____ Ingestion
Toxicity Data:	Rat, Inhalation LC_{50}: 6820 mg/m^3 (4 h) Rat, Oral LD_{50}: > 24 000 mg/kg Rat, Oral TD_{LO}: 60 g/kg
Medical Conditions Aggravated by Exposure:	Respiratory disorders.
Health Effects (Acute and Chronic):	See Section 3, "Hazards Identification".

12. ECOLOGICAL INFORMATION

Ecotoxicity:	Not available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal:	Dispose in accordance with federal, state, and local regulations.

14. TRANSPORTATION INFORMATION

SRM 674b U.S. DOT:	Not regulated by DOT.

15. REGULATORY INFORMATION

Titanium Dioxide

U.S. Regulations: CERCLA Sections 102a/103 (40 CFR 302.4): Not regulated.

SARA Title III Section 302 (40 CFR 355.30): Not regulated.

SARA Title III Section 304 (40 CFR 355.40): Not regulated.

SARA Title III, Section 313 (40 CFR 372.65): Not regulated.

OSHA Process Safety (29 CFR 1910.119): Not regulated.

California Proposition 65: Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE:	No.
CHRONIC:	No.
FIRE:	No.
REACTIVE:	No.
SUDDEN RELEASE:	No.

CANADIAN Regulations: WHMIS Classification: Not determined.

European EC Classification: Not determined.

National Inventory Status: U.S. Inventory (TSCA): Titanium dioxide listed on inventory.
TSCA 12b Export Notification: Titanium dioxide not listed.

16. OTHER INFORMATION

Sources: MDL Information Systems, Inc., MSDS *Titanium Dioxide,* 17 June 2004.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.

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Substances: Zinc Oxide (ZnO); Titanium Dioxide (TiO_2); **Chromium (III) Oxide (Cr_2O_3);** and Ceric Oxide (CeO_2)

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component: **Chromium (III) Oxide**

Other Designations: **Chromium (III) Oxide** (chromium oxide; chromic oxide; dichromium trioxide; chrome oxide; chromia; chromium (3+) trioxide; chromic acid green)

CAS Number: 1308-38-9

EC Number (EINECS): 215-160-9

SRM Nominal Concentration: 96 (mass %)

EC Classification: Not determined.

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0–4): Health = 1 Fire = 0 Reactivity = 0

Major Health Hazards: No significant effects reported.

Physical Hazards: Dust/air mixtures may ignite or explode.

Potential Health Effects

Inhalation: Inhalation may cause irritation. Symptoms may include coughing and chest discomfort. Repeated exposure may lead to sensitization.

Skin Contact: Acute and chronic skin exposure of trivalent chromium compounds may cause dermatitis. Allergic reactions may also occur in previously exposed persons.

Eye Contact: Acute eye exposure may cause irritation.

Ingestion: Ingestion may cause gastrointestinal irritation.

Listed as a Carcinogen/ Potential Carcinogen:

Yes	No	
	X	In the National Toxicology Program (NTP) Report on Carcinogens.
	X	In the International Agency for Research on Cancer (IARC) Monographs.
	X	By the Occupational Safety and Health Administration (OSHA).

4. First Aid Measures

Inhalation: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing by qualified personnel. Get immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention if necessary.

Eye Contact: Flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Get immediate medical attention.

Ingestion: If large amounts are ingested, get medical attention.

5. Fire Fighting Measures

Fire and Explosion Hazards: Chromium (III) oxide is a negligible fire hazard. Dust/air mixtures, however, may ignite or explode.

Extinguishing Media: Use extinguishing agents that are appropriate for the surrounding fire.

Fire Fighting: Move container from fire area if possible without exposure to risk. Avoid inhalation of material or combustion by-products. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point: Not applicable.

Method Used: Not applicable.

Autoignition Temperature: Not applicable.

Flammability Limits in Air
Upper (Volume %): Not applicable.
Lower (Volume %): Not applicable.

6. Accidental Release Measures

Occupational Release: Collect the material in an appropriate container for disposal.

Disposal: See Section 13, "Disposal Considerations".

7. Handling and Storage

Storage: Store and handle in accordance with all current regulations and standards. Keep separated from incompatible substances.

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

8. Exposure Controls and Personal Protection

Exposure Limits:
OSHA: 0.5 mg/m^3 TWA (soluble salts) (chromium [III] compounds)
OSHA: 1 mg/m^3 TWA (insoluble salts, metal)
ACGIH (TLV): 0.5 mg/m^3 TWA
NIOSH: 0.5 mg/m^3 recommended TWA (10 h)
OES UK: 0.5 mg/m^3 TWA (chromium [III] compounds)

Ventilation: Use a local exhaust ventilation system. Ensure compliance with applicable exposure limits.

Respirator: For conditions of frequent use or heavy exposure where exposure is apparent and engineering controls are not feasible, respirator protection may be needed. Refer to the "NIOSH Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84" for selection and use of respirators certified by NIOSH.

Eye Protection: Wear safety goggles. An eye wash station should be readily available near areas of use.

Personal Protections: Wear appropriate chemical resistant clothing to prevent skin exposure.

9. PHYSICAL AND CHEMICAL PROPERTIES

Component:	**Chromium (III) Oxide**
Appearance and Odor:	Green. Powder. Odorless.
Molecular Weight:	151.99 g/mol
Molecular Formula:	Cr_2O_3
Density:	5.21 g/cm^3
Solvent Solubility:	Insoluble in acids, alkali, alcohol, and acetone.
Water Solubility:	Insoluble.
Boiling Point:	4000 °C
Melting Point:	2435 °C

10. STABILITY AND REACTIVITY

Stability:	X Stable ____ Unstable
	Stable at normal temperatures and pressure.
Conditions to Avoid:	None reported.
Incompatible Materials:	Halogens. Metals. Combustible materials. Oxidizing materials. Metal carbide.
Fire/Explosion Information:	See Section 5, "Fire Fighting Measures".
Hazardous Decomposition:	Thermal decomposition may release miscellaneous decomposition products.
Hazardous Polymerization:	____ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry:	X Inhalation X Skin X Ingestion
Toxicity Data:	Rat, Inhalation TC_{LO}: 150 mg/m^3 (4 h to 6 weeks)
Medical Conditions Aggravated by Exposure:	Skin disorders. Allergies.
Health Effects (Acute and Chronic):	See Section 3, "Hazards Identification".

12. ECOLOGICAL INFORMATION

Ecotoxicity:	Not available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal:	Dispose in accordance with federal, state, and local regulations. Hazardous Waste Number D007. Dispose in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory Level of 5.0 mg/L.

14. TRANSPORTATION INFORMATION

SRM 674b U.S. DOT:	Not regulated by DOT.

15. REGULATORY INFORMATION

Chromium (III) Oxide

U.S. Regulations: CERCLA Sections 102a/103 (40 CFR 302.4): Not regulated.

SARA Title III Section 302 (40 CFR 355.30): Not regulated.

SARA Title III Section 304 (40 CFR 355.40): Not regulated.

SARA Title III, Section 313 (40 CFR 372.65): Chromium, Chromic, and Chromous compounds (as Cr).

OSHA Process Safety (29 CFR 1910.119): Not regulated.

California Proposition 65: Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE:	No.
CHRONIC:	No.
FIRE:	No.
REACTIVE:	No.
SUDDEN RELEASE:	No.

CANADIAN Regulations: WHMIS Classification: Not determined.

European EC Classification: Not determined.

National Inventory Status: U.S. Inventory (TSCA): Chromium (III) oxide listed on inventory.

TSCA 12b Export Notification: Chromium oxide not listed.

16. OTHER INFORMATION

Sources: MDL Information Systems, Inc., MSDS *Chromium (III) Oxide*, 16 September 2004.

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Substances: Zinc Oxide (ZnO); Titanium Dioxide (TiO_2); Chromium (III) Oxide (Cr_2O_3); and **Ceric Oxide (CeO_2)**

2. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Component: **Ceric Oxide**

Other Designations: **Ceric Oxide** (cerium [IV] oxide; cerium dioxide; ceria; cerium oxide)

CAS Number: 1306-38-3

EC Number (EINECS): 215-150-4

SRM Nominal Concentration: 91 (mass %)

3. HAZARDS IDENTIFICATION

NFPA Ratings (Scale 0–4): Health = 1 Fire = 0 Reactivity = 0

Major Health Hazards: No significant effects reported.

Potential Health Effects

Inhalation: Acute exposure by inhalation of ceric oxide may cause irritation of the nose and throat, nausea, and headaches. Long term exposure may cause the same effects as acute exposure along with lung damage.

Skin Contact: Acute exposure of ceric oxide to broken skin may cause hair loss and skin damage.

Eye Contact: Acute eye exposure of ceric oxide may cause irritation. The dust may be abrasive and irritating.

Ingestion: Toxicity is reported to be low due to poor gastrointestinal absorption.

Listed as a Carcinogen/ Potential Carcinogen:

Yes	No	
____	X	In the National Toxicology Program (NTP) Report on Carcinogens.
____	X	In the International Agency for Research on Cancer (IARC) Monographs.
____	X	By the Occupational Safety and Health Administration (OSHA).

4. First Aid Measures

Inhalation: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing by qualified personnel. Get immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention if necessary.

Eye Contact: Flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Get immediate medical attention.

Ingestion: If large amounts of ceric oxide are ingested, get medical attention.

5. Fire Fighting Measures

Fire and Explosion Hazards: Ceric oxide is a negligible fire hazard.

Extinguishing Media: Use extinguishing agents that are appropriate for surrounding fire.

Fire Fighting: Move container from fire area if possible without exposure to risk. Avoid inhalation of material. Wear full protective clothing and NIOSH-approved self-contained breathing apparatus (SCBA).

Flash Point: Not applicable.

Method Used: Not applicable.

Autoignition Temperature: Not applicable.

Flammability Limits in Air
Upper (Volume %): Not applicable.
Lower (Volume %): Not applicable.

6. Accidental Release Measures

Occupational Release: For large spills, collect the material in an appropriate container for disposal. Avoid generating dust. If necessary, use a high-efficiency particulate filter vacuum to clean up residue.

Disposal: See Section 13, "Disposal Considerations".

7. Handling and Storage

Storage: Store and handle in accordance with all current regulations and standards.

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

8. Exposure Controls and Personal Protection

Exposure Limits: No occupational limits established.

Ventilation: Use a local exhaust ventilation system.

Respirator: For conditions of frequent use or heavy exposure where exposure is apparent and engineering controls are not feasible, respirator protection may be needed. Refer to the "NIOSH Guide to the Selection and Use of Particulate Respirators Certified under 42 CFR 84" for selection and use of respirators certified by NIOSH.

Eye Protection: Wear safety goggles. An eye wash station should be readily available near areas of use.

Personal Protections: Wear appropriate chemical resistant clothing to prevent skin exposure.

9. PHYSICAL AND CHEMICAL PROPERTIES

Component:	**Ceric Oxide**
Appearance:	Powder. White to yellow in color.
Molecular Weight:	172.12 g/mol
Molecular Formula:	CeO_2
Density:	7.132 g/cm^3 @ 23 °C
Solvent Solubility:	Soluble in sulfuric acid and nitric acid. Insoluble in dilute acids.
Water Solubility:	Insoluble.
Boiling Point:	Not applicable.
Melting Point:	2600 °C

10. STABILITY AND REACTIVITY

Stability:	_X_ Stable ____ Unstable
	Stable at normal temperatures and pressure.
Conditions to Avoid:	Avoid generating dust.
Incompatible Materials:	No data available.
Fire/Explosion Information:	See Section 5, "Fire Fighting Measures".
Hazardous Polymerization:	____ Will Occur _X_ Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Entry:	_X_ Inhalation _X_ Skin _X_ Ingestion
Toxicity Data:	Rat, Intermittent Inhalation TC_{LO}: 50 mg/m^3 (4 h to 17 weeks) Rat, Oral LD_{50}: > 5 g/kg
Health Effects (Acute and Chronic):	See Section 3, "Hazards Identification".

12. ECOLOGICAL INFORMATION

Ecotoxicity:	Not available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal:	Dispose in accordance with federal, state, and local regulations.

14. TRANSPORTATION INFORMATION

SRM 674b U.S. DOT:	Not regulated by DOT.

15. REGULATORY INFORMATION

Ceric Oxide U.S. Regulations:	CERCLA Sections 102a/103 (40 CFR 302.4): Not regulated.
	SARA Title III Section 302 (40 CFR 355.30): Not regulated.
	SARA Title III Section 304 (40 CFR 355.40): Not regulated.
	SARA Title III, Section 313 (40 CFR 372.65): Not regulated.
	OSHA Process Safety (29 CFR 1910.119): Not regulated.
	California Proposition 65: Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE:	Yes.
CHRONIC:	No.
FIRE:	No.
REACTIVE:	No.
SUDDEN RELEASE:	No.

CANADIAN Regulations: WHMIS Classification: Not determined.

European EC Classification: Not determined.

National Inventory Status: U.S. Inventory (TSCA): Ceric oxide listed on inventory.

TSCA 12b Export Notification: Ceric oxide not listed.

16. OTHER INFORMATION

Sources: MDL Information Systems, Inc., MSDS *Ceric Oxide,* 18 September 2003.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use as a guide in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data in the MSDS. The certified values for this material are given in the NIST Certificate of Analysis.